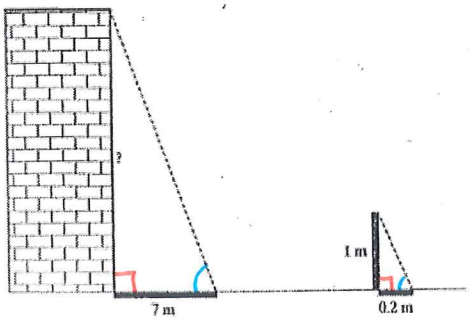
Name:_____

Indirect Measurement Notes

1. The Shadow Method of Indirect Measurement

Mrs. Smith's class is using the shadow method to estimate the height of their school building. They have made the following measurements and sketch:

Length of the meterstick = 1 m
Length of the meterstick's shadow = 0.2 m
Length of the building's shadow = 7 m



vertical side, horizontal side

large △ → $\frac{x}{1} = \frac{7}{0.2}$

small △ →

$0.2x = 7$

$x = 35$ m

always include your units!

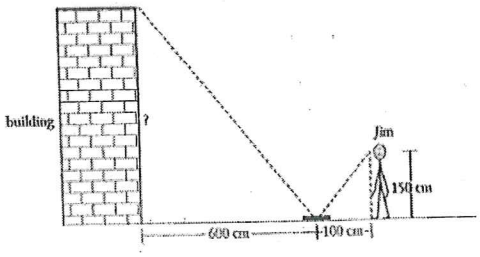
Use what you know about similar triangles to find the building's height from the given measurements. Explain your work.

AA similarity tells us we have similar triangles

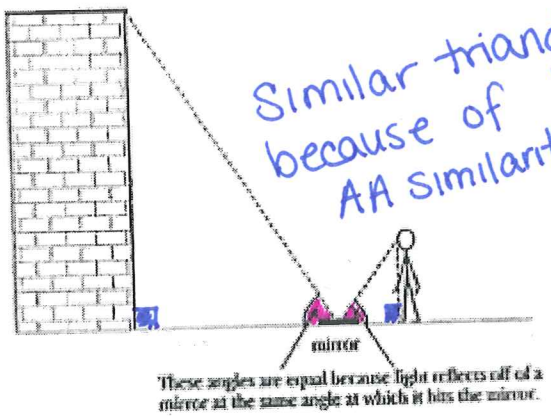
2. The Mirror Method of Indirect Measurement

Jim and Sally, students in Mrs. Smith's class, are using the mirror method to estimate the height of their school building. They have made the following measurements and sketch:

Height from the ground to Jim's eyes = 150 cm
Distance from the middle of the mirror to Jim = 100 cm
Distance from the middle of the mirror to the building = 600 cm



Hint:



Similar triangles because of AA similarity

small △ → $\frac{150}{x} = \frac{100}{600}$ ← horizontal (length)

large △ → ↑ vertical (height)

$90000 = 100x$

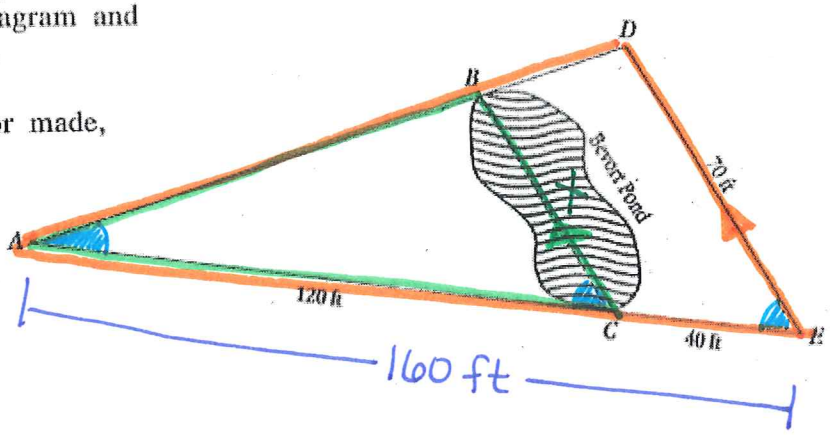
$900 \text{ cm} = x$

3. Triangle within a Triangle Example

Mrs. Smith's class went to Beaver Pond for a picnic. Darnell, Angie, and Trevor wanted to find the distance across the pond. Darnell and Angie suggested that Trevor swim across with the end of a tape measure in his mouth. Trevor declined - the water was very cold! They decided to try to use what they had learned about similar triangles to find the distance across the pond. They drew a diagram and started making the necessary measurements.

Here is the diagram Darnell, Angie, and Trevor made, including their measurements.

Similar triangles by AA Similarity



$\frac{70}{x} = \frac{160}{120}$ ← large △ / ← small △

$160x = 8400$

$x = 52.5$ ft

Triangle Similarity-Indirect Measurement

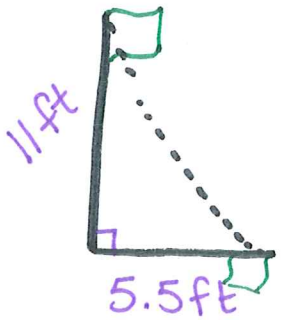
Shadow Problem:

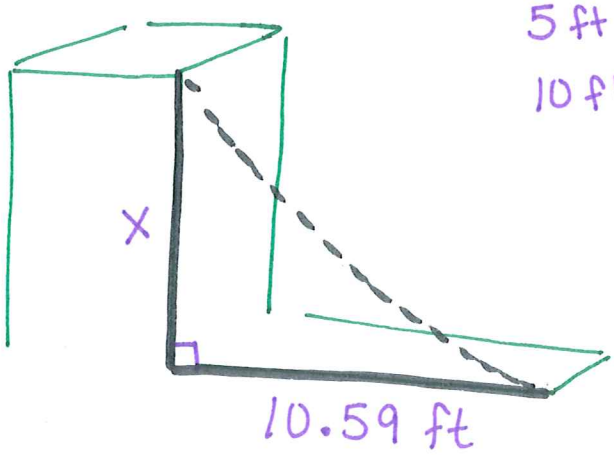
A flagpole that is 11 feet tall casts a 5 and a half foot shadow. At the same time of day, a nearby building casts a 10 feet, 7 in. shadow. How tall is the building? (Hint: we need to convert)

Convert everything to feet... we can't have 2 types of measurements in the problem!

5 ft 6 in = 5.5 ft

10 ft, 7 in = 10.583 ft ≈ 10.59 ft





building → $\frac{10.59}{5.5} = \frac{x}{11}$ ← flagpole

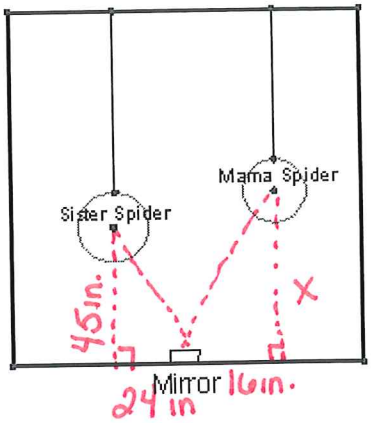
shadow ↑ ↑ height

$116.49 = 5.5x$

$x = 21.18$ ft

Mirror Problem:

A family of spiders has found a mirror on the ground and they have been positioning themselves to see each other in the mirrors. Mama and Sister spider are shown below. Sister spider, who is 45 inches off the ground, can see Mama spider in the mirror that is on the ground between them. The mirror is 24 inches from the point directly below Sister spider and 16 inches from the point directly below Mama spider. How far is Mama spider form the ground? Please write in all the measurements in the correct places in the diagram.



Sister spider → $\frac{24}{16} = \frac{45}{x}$ ← distance from ground

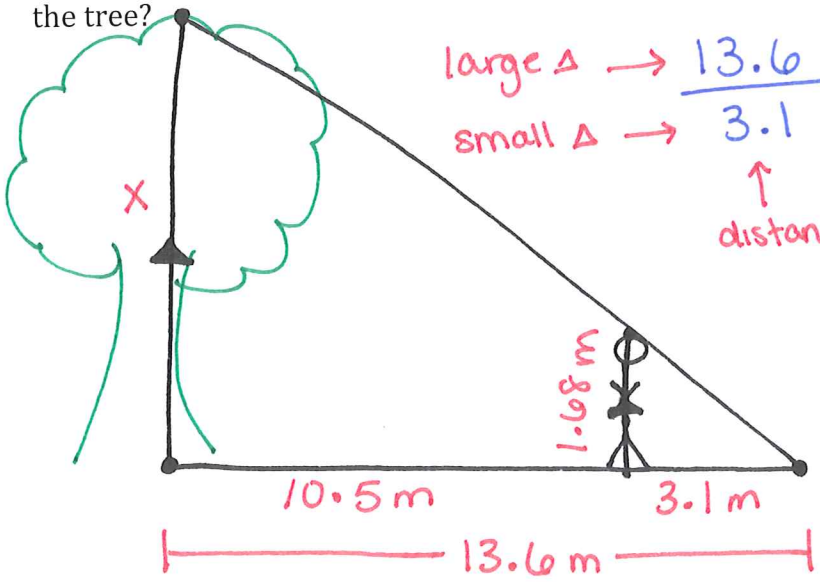
Mama spider → 16 ← distance from mirror

$24x = 720$

$x = 30$ in.

Triangle within a Triangle Problem:

Mary Ellen, who is 1.68 meters tall, wants to find the height of a tree in her backyard. From the tree's base, she walks 10.5 meters along the tree's shadow to a position where the end of her shadow exactly overlaps the end of the tree's shadow. She is now 3.10 meters from the end of the shadows. How tall is the tree?



large Δ → $\frac{13.6}{3.1} = \frac{x}{1.68}$ ← small Δ

↑ distance ↑ height

$3.1x = 22.848$

$x = 7.37$ m